



**Approved by the NextGen Advisory
Committee February 2017**

**Joint Analysis Team:
Performance Assessment
of Wake ReCat in Indianapolis and
Philadelphia and Fuel Analysis for
North Texas Metroplex**

*Report of the NextGen Advisory Committee in Response
to Tasking from the Federal Aviation Administration*

February 2017

Joint Analysis Team: Wake ReCat in IND/PHL & Fuel Analysis in North Texas

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Introduction/Background

The NextGen Advisory Committee (NAC) has been instrumental in helping the Federal Aviation Administration (FAA) move forward with NextGen implementation. In 2014, the Committee approved a recommendation for a set of integrated plans on four focus areas of NextGen capabilities (DataComm, Multiple Runway Operations, PBN, and Surface).

These plans were developed by a joint FAA-Industry team, the NextGen Integration Working Group (NIWG), operating under the NAC. The goal of the NIWG is to identify implementation priorities that deliver measurable benefits by certain dates, and, thereby, increase the community's confidence in NextGen.

In June 2015, the NAC considered and approved six high level performance metrics intended to measure performance impacts attributable to the deployment of the four key NIWG capabilities outlined in the "NextGen Priorities Joint Implementation Plan" of October 2014. The set of metrics are intended for the FAA and industry to collaboratively monitor performance to understand the impact of implementations. The six metrics (detailed in Appendix B) are:

- | | | |
|--|---|------------------------|
| 1. Actual Block Time | } | Measured by city pairs |
| 2. Actual Distance Flown | | |
| 3. Estimated Fuel Burn | | |
| 4. Throughput – Facility Reported Capacity Rates | } | Measured at airports |
| 5. Taxi-Out Time | | |
| 6. Gate Departure Delay | | |

Subsequently, the NAC formed the Joint Analysis Team (JAT) which includes operational and analytical experts from the FAA and industry. The JAT was formed to reach a common statement of fact regarding performance impacts and benefits that can be attributed to implementation of NextGen capabilities. To accomplish this goal, the JAT has analyzed data, metrics, methods and tools typically used by each of the parties in this type of assessment. This has included analyses of other measures deemed appropriate beyond the six metrics noted above.

The JAT has previously evaluated the following capabilities at the following locations:

- Wake ReCat Implementations at Charlotte Douglass International Airport (CLT), O'Hare International Airport (ORD) and Chicago Midway International Airport (MDW)
- Performance Based Navigation (PBN) Metroplex Implementation in North Texas
- PBN Established on RNP (EoR) in Denver International Airport (DEN)

This report includes findings on Wake ReCat implementation in Indianapolis International Airport (IND) and Philadelphia International Airport (PHL).

Methodology

The JAT is comprised of data and analysis experts from the FAA as well as the aviation industry, and the team conducted a series of meetings to discuss and review ongoing analysis. This team utilized a methodology previously agreed upon by the JAT to evaluate the impacts of ReCat. Analysis of ReCat in IND included an additional challenge that runway on and off times from Airport Surface Detection Equipment, Model X (ASDE-X) were not available. As an alternative, the JAT utilized MITRE Threaded Track data to select a common point in the air by runway to approximate on and off times. For arrivals, the analysis uses the time at which the aircraft was 1 nautical mile (NM) from the runway threshold along the final approach course. For departures, the analysis uses the time at which the aircraft was 2.25NM from the opposite runway threshold along the take-off path. The JAT believes this approximation was sufficient to conduct the ReCat impact analysis.

The working dynamic between the FAA and industry team members remains a positive and professional one in which capable analysts from different perspectives challenged one another's perspectives. The final product of this body is the result of strong collaboration and sharing of data and ideas between the FAA and industry. The JAT continues to build trust and confidence amongst members throughout this process.

Summary of Findings

- The JAT analysis methodology for ReCat has been applied to multiple ReCat 1.5 implementation sites (CLT, ORD, MDW, IND) and a ReCat 2.0 site (PHL) using different aircraft pair separation matrices. Additionally it has been applied using ASDE-X and Threaded Track data. The methodology is robust as it has been applied successfully in all of these cases.
- Fleet mix and overall demand levels continue to be critical drivers of ReCat impact. Busy airports with a higher presence of Heavy, 757 and Small aircraft are expected to see the greatest impacts.
- Airborne or taxi out savings can be expected when ReCat impacted flights operate to an individual runway that is experiencing pressure. As long as pressure remains, savings accrue for all subsequent aircraft.
- Throughput improvement can be expected when ReCat-impacted flights operate in peak demand. Modeled throughput based on actual separation changes indicates improvement.
- JAT's ReCat methodology may be leveraged to prioritize future implementations of ReCat.

Summary of Data Analysis Results

The JAT has now conducted ReCat analysis for five airport sites: IND, PHL, CLT, ORD and MDW. Results are summarized in the table below. A full set of analysis details may be found in Appendix C.

Implications of Wake ReCat		Airports				
		IND	PHL	CLT	ORD	MDW
Percent of eligible pairs¹ of flights at the airport potentially impacted by ReCat (% with decreased separation / % with increased separation)	Arrivals	22.5% / 4.4%	7.7% / 0.4%	2.6% / 0.0%	4.4% / 0.0%	1.1% / 0.0%
	Departures	23.3% / 3.8%	7.9% / 0.3%	3.3% / 1.1%	4.7% / 0.6%	1.1% / 7.6%
Estimated total savings in Airborne and Taxi Out Time due to ReCat²	Airborne	\$321K	\$545K	\$180K	\$590K	-\$2K
	Taxi Out	\$2,033	\$220K	\$57K	\$360K	-\$32K
	Total	\$2,400K	\$765K	\$237K	\$950K	-\$34K

Fuel Analysis in North Texas

Previous JAT analysis on the impact of the North Texas Metroplex demonstrated the need for additional work to determine a joint FAA-industry approach to estimate the fuel impacts from the Metroplex activity. The final results of this effort are included in Appendix C to this report.

¹ Eligible pairs of flights are sequential flights on the same runway that are the same type of operation (both arrival or both departure), are within 5 minutes of each other and operate during the study's reporting hours.

² The JAT used queueing models to estimate impacts on taxi time. Estimated savings impact includes value from rule change for 757s published in 7110.65W in December 2015.

Appendix A: Members of the Joint Analysis Team

John Heimlich	Airlines for America
Christopher Oswald	Airports Council International (ACI North America)
Ilhan Ince	American Airlines, Inc. (Co-Chair)
Balaji Nagarajan	American Airlines, Inc.
Denise Neumann	American Airlines, Inc.
Brian Will	American Airlines, Inc.
Stephen Smothers	Cessna Aircraft Company
Colin Rice	City of Houston, Texas
Eugene Maina	Dallas/Fort Worth International Airport
Steve Tobey	Dallas/Fort Worth International Airport
Patrick Burns	Delta Air Lines, Inc.
Thomas Carroll	Delta Air Lines, Inc.
Steve Dickson	Delta Air Lines, Inc.
Barrett Nichols	Delta Air Lines, Inc.
Ken Speir	Delta Air Lines, Inc.
Martin Durbin	Federal Aviation Administration (FAA)
Paul Eckert	Federal Aviation Administration (FAA)
Pamela Gomez	Federal Aviation Administration (FAA)
Shane Hart	Federal Aviation Administration (FAA)
Leslie Higgins	Federal Aviation Administration (FAA)
Dave Knorr	Federal Aviation Administration (FAA) (Co-Chair)
Brian Kravitz	Federal Aviation Administration (FAA)
Lauren Lloyd	Federal Aviation Administration (FAA)
Dan Murphy	Federal Aviation Administration (FAA)
Juan Narvid	Federal Aviation Administration (FAA)
Lawrence Pugh	Federal Aviation Administration (FAA)
Almira Ramadani	Federal Aviation Administration (FAA)
LaVada Strickland	Federal Aviation Administration (FAA)
Dan Allen	FedEx Express
Bradley Ammer	FedEx Express
Matt Duty	FedEx Express
Kyle Smith	FedEx Express
Joe Bertapelle	JetBlue Airways
Ken Elliott	Jetcraft Avionics LLC
Lee Brown	Landrum-Brown
Mark McKelligan	National Air Traffic Controllers Association (NATCA)
David Brukman	PASSUR Aerospace
Chris Maccarone	PASSUR Aerospace

Rob Golden	QED Consulting, LLC
Andy Cebula	RTCA, Inc.
Margaret Jenny	RTCA, Inc.
Trin Mitra	RTCA, Inc.
Brandi Teel	RTCA, Inc.
Bill Sperandio	Southwest Airlines
Tass Hudak	The MITRE Corporation
Bobby Kluttz	The MITRE Corporation
Pete Kuzminski	The MITRE Corporation
Debby Pool	The MITRE Corporation
Jeff Shepley	The MITRE Corporation
Marc Brodbeck	United Airlines, Inc.
Alex Burnett	United Airlines, Inc.
Glenn Morse	United Airlines, Inc.
Kevin Swiatek	United Parcel Service (UPS)

Appendix B: NAC Performance Metrics

	<u>Metric</u>	<u>Reported Values</u>	<u>Comments</u>
Measured on applicable existing 104 city-pairs:	1. Actual Block Time	Mean and std dev or 60% percentile	<ul style="list-style-type: none"> Actual time from Gate-Out time to Gate-In time for a specified period of time by city pair GA: IFR flight time from ramp taxi to ramp park
	2. Actual Distance flown	Mean and std dev or 60% percentile	<ul style="list-style-type: none"> Actual track distance between key city pairs for a specified period of time GA: IFR flight distance from take-off to TOC & from TOD to touch down
	3. Estimated Fuel burn	Mean and std dev	<ul style="list-style-type: none"> Actual fuel burn for a specified period of time
Measured at applicable airports	4. Throughput – facility reported capacity rates*	Mean and peak capacity rates	<ul style="list-style-type: none"> Facility Airport Arrival Rates (AAR) & Arrival Departure Rate (ADR) Airlines (recommend: http://www.fly.faa.gov/ois however, the working group is open to alternate measurements that meet the requirements) GA: measured as access events – Radar vector and not SID as OUT event and Ground based nav and not GPS / WAAS-LPV as IN event
	5. Taxi-out Time*	Mean and std dev or 60% percentile	<ul style="list-style-type: none"> Actual time from Gate-Out to Wheels-Off time by airport (minutes/flight) GA: IFR flight taxi time from ramp taxi to take off
	6. Gate Departure Delay	Delays/100 act depts. And total delay minutes	<ul style="list-style-type: none"> Difference in actual Gate-Out time and scheduled Gate-Out time, Not measured for GA

* - Identified by FAA

1 GA data may not currently be collected